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# ALFALFA

FOR THE

## GROWING AND FATTENING OF ANIMALS IN THE GREAT PLAINS REGION.

BY

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# ALFALFA FOR THE GROWING AND FATTENING OF ANIMALS IN THE GREAT PLAINS REGION.

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## PRELIMINARY REMARKS.

Alfalfa is the most valuable and most important plant known to Western agriculture. No other agricultural product has grown so rapidly in public esteem in the last ten or fifteen years as has this one. This statement is intended to apply more especially to the vast region lying to the south and west of the Missouri River, as it has not yet been demonstrated that alfalfa and its related plant, red clover, are equally adaptable to the same conditions of soil and climate. The alfalfa plant seems especially adapted to the high plains of what once was known as the semiarid region, because of its ability to resist drouth and because of its enormous root growth, which penetrates the subsoil to regions of perpetual moisture. It has long been known to the primitive agriculturists of the western portion of the territory included in the Louisiana purchase, but its adaptability and value as an agricultural product have been appreciated in the region lying between the Mississippi River and the Rocky Mountains only in recent years. A good illustration of its growth in public favor is shown by the statistical reports of the Kansas Board of Agriculture, which state that in 1891 Kansas had 34,384 acres, while in 1904 she had a total of 557,509 acres in growing alfalfa.

This large and new horizon of the alfalfa plant has revolutionized the animal husbandry of this great region and has opened up a very large area that was heretofore considered useless, or nearly so, for the production, not only of a living for the stock-growing farmer and his family, but of an absolutely certain means of obtaining wealth as well. Its capability of growing and producing a profitable crop under adverse climatic conditions, the certainty with which it develops, and its value when produced have served to remove the element of uncertainty which so long hindered the development of profitable agriculture in the Great Plains region.

In bringing together facts about the alfalfa plant the writer has drawn liberally upon the experimental work performed by the differ-

ent experiment stations, not because this is the only source of information, but rather because these results are published in accurate and scientific form, though they represent what is common to the practice of feeders and farmers throughout the alfalfa region.

One peculiarity of the alfalfa plant lies in its habit of sending roots down deep into the earth. After it is once well established it becomes a perennial that is practically independent of climatic conditions. The writer has a personal knowledge of a field of alfalfa in Kansas that was well established in 1878, when he first saw it, and that has been in alfalfa ever since, with no reseeding and no care other than to mow the crops and disk the surface of the ground occasionally.

One of the most valuable characteristics of this plant, however, is its ability, in common with other legumes, to gather nitrogen from the atmosphere, with the result that the plant itself becomes a highly nitrogenous food for domestic animals, and its growth serves to enrich the land instead of impoverishing it.

#### ITS COMPONENT PARTS CONSIDERED.

In the development of young animals, the supplying of muscle for the work horse, and in the producing of milk, it is found that protein is the important element. Carbohydrates may be substituted for fats, or vice versa, within reasonable limits, and without detriment to the animal, and protein may to some extent be substituted for either; but neither carbohydrates nor fats can be substituted for protein. Protein is an essential element in the food of both man and beast. It is the element producing muscle and tendon, and hence is necessary to the proper growth and development of all young animals, and is most easily supplied to them through rich nitrogenous foods. The alfalfa plant has been found to be so rich in protein that it ranks high above all other feeds that are used for roughage and stands well up among the more concentrated feeds. It has been found by experiment that 100 pounds of alfalfa contain 3.3 pounds more of total digestible nutrients than does wheat bran and almost as much protein. It is richer in digestible protein than wheat, corn, oats, rye, barley, Kafir-corn seed, or sorghum seed. Its nutritive ratio is so narrow that it is equaled only by wheat bran, linseed meal, cotton-seed meal, and soy beans. Alfalfa is an ideal feed for the development of young stock in muscle and general growth and for the milch cow. It is especially valuable, in combination with corn, as a ration for fattening steers, since it furnishes all the roughage necessary and is a very cheap source of protein. For the sake of comparison, the following table, showing percentage composition of some of the commoner feedstuffs, is given:

*Composition of some common feedstuffs.*

Feedstuff.	Protein (contain- ing nitro- gen).	Nitrogen- free ex- tract (car- bohy- drate)	Ether ex- tract (fat).
Soy beans .....	34.0	28.8	16.9
Dent corn .....	10.3	70.4	5.0
Linseed meal .....	33.2	38.4	4.0
Red clover (fresh) .....	4.4	13.5	1.5
Timothy (fresh) .....	3.1	20.2	1.2
Red clover (hay) .....	12.3	38.1	3.3
Alfalfa hay .....	14.3	42.7	2.2
Timothy hay .....	6.0	41.9	3.0

Digestion experiments made at the Kansas Experiment Station show that air-dry alfalfa hay contains 10.43 per cent of protein, 0.69 per cent of fat, 28.18 per cent of carbohydrates, and 15.99 per cent of crude fiber; the total digestible nutrients being 55.29 per cent. For the sake of further comparison it may be stated that the percentage of total digestible nutrients of other common feeds used for roughage is as follows: Millet 57.6, oat hay 52.2, orchard-grass hay 48.2, timothy hay 48, prairie hay 46.7, sorghum hay 44.2, red-clover hay 43.9, corn fodder 35.8. It will be noted that only one of these feeds equals alfalfa in total digestible nutrients. But in making this comparison it must be remembered that it costs much more to produce feeds rich in protein than it does to produce those rich in carbohydrates, and consequently, of two feeds containing an equal amount of digestible nutrients the one containing the more protein is the more valuable. When alfalfa is compared with the other feeds just named, it is found to rank far ahead of the richest of them. One hundred pounds of alfalfa hay contains 11.3 pounds more digestible matter than the same amount of red-clover hay and one and one-half times as much protein. It contains 2.3 pounds less of total digestible nutrients than the same amount of millet hay and almost two and one-half times as much digestible protein. It contains two and one-half times as much digestible protein as oat hay, three times as much as prairie hay, more than four times as much as sorghum hay, five times as much as corn fodder, and thirteen times as much as wheat straw.

It will thus be seen that alfalfa furnishes a feed which is almost a perfect ration for the growing animal and the milch cow, and that, in order to fatten an animal, it is only necessary to add some other feed that is rich in fats and carbohydrates to make an ideal combination.

Some time since, Mr. E. B. Cowgill, editor of the *Kansas Farmer*, at Topeka, did some very valuable work in determining the value of









To illustrate the use of these tables, let a ration be computed for a 1,000-pound dairy cow giving 22 pounds of milk per day. Suppose we have on the farm dent corn and timothy hay. This cow will, according to the table of feeding standards, require 29 pounds of dry matter a day (by dry matter is meant ordinary dry corn and hay). She must, then, have for a daily ration 2.5 pounds of protein, 13 pounds of carbohydrates, and 0.5 pound of fats. As the only way thus far for the determination of a properly balanced ration is the "cut and try" method, we will guess that the cow should have 10 pounds of corn chop and 19 pounds of hay per day. This would give her a ration, according to the table of feedstuffs, as follows:

Feedstuff.	Proteins.	Carbo- hydrates.	Fats.	Value.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Cents.</i>
Corn chop, 10 pounds .....	0.8	6.7	0.4	5
Timothy hay, 19 pounds .....	.5	8.2	.3	5
Total .....	1.3	14.9	.7	10
Standard requirements .....	2.5	13.0	.5	15½

This ration has too much digestible carbohydrates and fats and only about half enough protein. In other words, it is a ration for fattening animals rather than for milk production, and the cow will probably lay on weight and decrease in her milk flow. If the animal weighs 1,000 pounds, it will require more than 1 pound of protein per day to sustain her, even though she give no milk. If we deduct this from the amount shown by the proposed ration, we have but 0.3 pound of protein for the milk production. As 22 pounds of average milk contains 0.8 pound of protein, it will be seen that the proposed ration is inadequate. It will also be noticed that it has less value than the standard ration would be worth at ordinary prices for feeding stuffs. How shall this ration be changed to give it the required amount of protein at reasonable cost? The answer is this: By substituting alfalfa hay for timothy. When this is done we have a value shown in the following table, in which the alfalfa is rated at \$10 per ton, which is rather above the average in the region under consideration:

Feedstuff.	Proteins.	Carbo- hydrates.	Fats.	Value.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Cents.</i>
Corn chop, 10 pounds .....	0.8	6.7	0.4	5
Alfalfa hay, 19 pounds .....	2.1	7.5	.2	9½
Total .....	2.9	14.2	.6	14½
Standard requirements .....	2.5	13.0	.5	15½

Nearly every farmer would be glad to realize \$5 per ton per year for alfalfa; if this value is placed upon it the cost of the ration will be reduced to 9 $\frac{3}{4}$  cents, which more nearly represents the actual feeding conditions in this region. A glance at the table shows that the ration is richer in all of its constituents than is necessary for the supposed case. This is reduced by substituting cane, Kafir corn, or timothy hay for a portion of the alfalfa. Should the animal be unable to digest so much hay, she may be given some concentrated nitrogenous feed, like soy-bean meal, linseed meal, or glucose meal for a portion of the alfalfa. The examples given here are simply intended for illustration and not for model rations. The feeder will determine what problem he has on hand—whether it is that of the development of a young animal or the production of beef, milk, or muscle—and will then make his rations from the material at hand, with the aid of the values shown in the table.

#### VALUE OF THE HAY AT DIFFERENT PERIODS OF GROWTH.

Another important point to be considered in connection with the feeding value of alfalfa is the quality to be obtained through the harvesting and care of the plant. Experiments made at the Kansas Experiment Station in regard to the value in protein of alfalfa, cut at different periods of its growth, show the following results:

	Per cent.
One-tenth in bloom.....	18.5
One-half in bloom.....	17.2
In full bloom.....	14.4

It was also found here that the late cutting of the first crop seemed to injure the plant more than cutting at any other time; indeed, it was found more profitable to make the first cutting of alfalfa as soon as the field was one-tenth in bloom, even though the weather conditions prohibited the saving of the crop without spoiling. The increased yield from succeeding cuttings over that which was cut late much more than makes up for the loss of the first crop. Farmers who have been successful clover growers often spoil their first stand of alfalfa because they wait to cut it at the stage when red clover is usually cut.

In Utah the experiment station cut alfalfa at different stages of maturity, and fed the crop in the experiment of producing beef, which covered a period of five years, to determine the best time for cutting alfalfa for this purpose. The average production per year per acre was as follows:

	Hay.	Beef.
	Tons.	Pounds.
In first bloom .....	3.35	706
In full bloom .....	4.90	562
Half the blooms fallen.....	4.55	490

In addition to the facts stated in the above tables in favor of the early harvesting of alfalfa, it should be noted that soon after the alfalfa plant begins to blossom a number of the leaves turn yellow and fall to the ground. As the leaves are more valuable as feed because of their higher percentage of protein and lower proportion of crude fiber, it is of interest to know the necessity for early harvesting in order that a greater proportion of leaves may be saved in the hay. Experiment shows that the greatest proportion of leaves is found just before the blossoming period, but that the plant is so immature at this time that its greatest value for feed is not reached until it is about one-tenth in bloom. Analyses of the dry matter of the leaves, taken at the time that the first blossoms appear, show 23.06 per cent of crude protein, while average wheat bran contains about 16 per cent only of crude protein. These same analyses show that six days before harvesting the crop the leaves contain 63 per cent of the total nitrogen of that part of the plant above ground. Eight days later they contain 57 per cent, showing a loss of 6 per cent of nitrogen transferred from the leaves to the stem.

#### ALFALFA FOR PASTURE.

In making his investigations the writer has visited the farms of many large alfalfa growers and of many large feeders who use it for the development of beef, pork, or milk, though they may not grow all they feed. Among these men there was found a wide difference of opinion as to the value of alfalfa for pasture. One very prominent breeder of Angus cattle is positive in his statements that alfalfa should never be pastured, while an equally prominent breeder of Shorthorn cattle maintains that it is the most valuable of pastures when mixed with grasses and other clovers. It is conceded by all that it is an unequaled pasture for horses and hogs, but that it contains an element of danger for such ruminants as cattle and sheep. In the early history of alfalfa in the region east of the Rocky Mountains many farmers and feeders lost their cattle through their ignorance of the fact that it will produce hoven, or bloat, when carelessly pastured. Experience has taught them, however, that it can be used successfully as a pasture, and apparently without danger to the animal, provided that care is taken to see that the animal never goes onto the alfalfa pasture except with a full stomach. Cattle are so fond of this clover that they eat greedily of it, and the tendency is to gorge themselves if they go to the pasture hungry. The result is bloat and a loss of the cattle.

Experience also teaches that cattle and sheep must never be turned upon alfalfa pasture while the dew is yet on it or just after a rain. Many cattlemen find that they can accustom their cattle to alfalfa

pasture by allowing them to feed for a few minutes each day at first and by gradually lengthening the period until they can eat alfalfa from the pasture with apparent impunity, though the element of danger is never entirely removed.

In this connection the experience of a very prominent breeder of Shorthorn cattle who has made a success in the show ring and who is also a feeder on a large scale will be of interest. For the past sixteen years he has made a practice of sowing alfalfa with other clovers and grasses, so that he has a rich pasture, which keeps his cattle in the highest possible condition and with absolutely no danger from bloat. At least, he states that in this period of sixteen years he has never lost an animal nor had one affected by bloat from pasturing on this mixed pasture. His combination of seeds for 1 acre of rich bottom land is as follows: Four pounds of alfalfa, 3 pounds of red clover, 10 pounds of orchard grass, 10 pounds of English bluegrass, and 1 quart of timothy. For uplands or those which are less able to maintain heavy seeding he reduces the amounts of seed according to his judgment and past experience, the proportions remaining the same. As this gentleman is a breeder of high-class Shorthorn cattle, and as his Shorthorns and stock cattle are always in fine condition when on pasture, and as his experience in the use of this pasture covers so long a period of time, his practice has been copied by others, who are meeting with equal success.

For the drier regions it is suggested that *Bromus inermis* be substituted for the English bluegrass or orchard grass, or both, as it has practically the same reputation for hardiness as has the alfalfa, and experience teaches that a satisfactory pasture may be made by sowing one-half of this grass and one-half alfalfa.

Alfalfa pastures when properly handled are very enduring, though they should not be pastured the first year and only moderately the second year. If the animals do not serve to restrain the too vigorous growth of the plants, the pasture should be cut with a mower occasionally to keep down the weeds and to prevent the alfalfa from seeding, which is an exhaustive process. The alfalfa should never be closely pastured late in the fall, as it needs a protection for the crowns during the winter. If the crowns are laid bare by close pasturing, the plants will not stand the winter and the pasture will be permanently injured. Animals should never be turned upon the alfalfa after the ground has been frozen and a slight thaw has softened the surface; nor should they be turned on it when the ground is rendered soft from rainfall, as the hoofs of the animals will do material damage to the crowns, with a resulting disaster to the pasture. These remarks should also apply to pasturing hogs, which not only damage the crowns of the plant with their sharp hoofs, but also injure or destroy it by rooting.

However, as alfalfa alone is not recommended for cattle and sheep pasture, but is found to be much more valuable and less dangerous when used as hay or for soiling purposes, it may be interesting to turn to the wider uses of the plant.

#### ALFALFA FOR SOILING.

As alfalfa grows rapidly, it is available for use as feed early in the season, and as its period of growth is a long one each year, it is equally available for feed late in the season. No plant has been discovered which can equal it when used for soiling. Its use in this manner entirely does away with the danger from bloat which is experienced in pasturing it. Every class of farm animals likes it and eats it greedily, but it is especially valuable for the dairy cow. The small dairyman can keep his cattle inclosed in small area, and, by soiling with alfalfa, can keep them in the best of health and the highest flow of milk and without expense for other feed. A very high authority reports that 10 mature cows giving milk were fed an entire summer on alfalfa from 4 square rods less than 2 acres. A cutting was made once each day and the cows fed twice daily without other feed. This was not an exceptionally prepared plat of ground, nor was the growth more rapid than is ordinarily found on the average Western bottom land. After the alfalfa has thoroughly established itself the amount of feed that will be furnished for soiling purposes on even a small plat of ground is almost incredible. When used for soiling it is the judgment of the writer that the plants should be allowed to wilt somewhat before it is fed, as this entirely removes any danger from bloat. If the alfalfa is of rank growth, is very green, or when wet from showers or dew, it is much better to allow time for it to wither than to assume the risk which would follow the feeding of it under those conditions.

While this may seem to be a cumbersome method of harvesting and not suited to the general farmer or cattle feeder, it still has its uses, and it has been demonstrated that it is much cheaper to grow and harvest alfalfa in this manner than to grow and harvest corn. Alfalfa will yield almost twice as much dry matter per acre as will corn. While corn is more digestible and has a higher feeding value when fat is desired than has an equal amount of alfalfa, it will rapidly exhaust the soil, while alfalfa gathers its stores of plant food from the atmosphere and enriches rather than depletes the soil.

#### ALFALFA FOR HAY.

Alfalfa has been known to yield as much as  $5\frac{1}{2}$  tons of hay per acre, or nearly twice as much as an equal area of corn, while the crop on an acre of corn has a feeding value equivalent to about  $3\frac{1}{2}$  tons

of alfalfa hay. Alfalfa is cut about three times, on an average, in the region under consideration during each season, and the first cutting is always the heaviest. The figures representing the yield taken from one field are here given, not as an index of the usual yield, but to show the proportionate weight of the several cuttings. From this field the first cutting yielded 4,600 pounds of hay per acre, the second 3,350 pounds, and the third 3,250 pounds, or a total of 5.6 tons per acre for the season's yield. If the plant is cut so late that a considerable portion of the leaves have fallen, the remainder of the hay will be composed of a large percentage of indigestible vegetable fiber. Should the hay be allowed to mold, or heat, some of the most valuable elements of nutrition will be destroyed. When alfalfa hay is properly cured and housed it does not deteriorate with age, and retains much of the succulent qualities of green grass in the early season. It keeps the digestive organs active and open and has a cooling effect upon the blood. The following table shows the comparative value of alfalfa hay and other common feeds, calculated upon the quantity of digestible protein contained in each:

Feedstuff.	Value per ton when prairie hay is worth—		
	\$2 per ton.	\$3 per ton.	\$4 per ton.
Alfalfa hay (choice) .....	\$7.36	\$11.05	\$14.73
Alfalfa hay (average) .....	6.05	9.08	12.11
Red-clover hay .....	3.88	5.82	7.77
Orchard-grass hay .....	2.74	4.11	5.48
Millet hay .....	2.57	3.85	5.14
Timothy hay .....	1.65	2.48	3.31
Sorghum hay .....	1.37	2.05	2.74
Corn fodder (stover) .....	1.14	1.71	2.28
Oat straw .....	.91	1.37	1.82
Wheat straw .....	.45	.68	.91
Sugar beets .....	.62	.94	1.25
Mangel-wurzels .....	.57	.85	1.14
Wheat bran .....	7.02	10.53	14.04

This table is quoted from Hon. F. D. Coburn, secretary of the Kansas Board of Agriculture, and shows that the choice alfalfa is superior in feeding value to wheat bran, while the average alfalfa hay is but little inferior to it. Animals accustomed to alfalfa seem never to tire of it, and many instances are known where animals will leave fresh grass pastures and feed from a stack of alfalfa hay.

Analyses of the dry matter in alfalfa shows the digestible portion of the leaves of the plant to be 51.75 pounds per hundredweight of hay and the digestible portions of the stems to be 51.27 pounds per hundredweight of hay. While the leaves and stems are nearly equal in the amount of digestible matter, the same analyses show that the nutritive ratio of the leaves is 1:4.5, while that of the stems is 1:7.2,

which is a very much wider ratio and would be suitable for horses at work, while the leaves are better adapted to the needs of young and growing stock or of dairy cows.

#### ALFALFA MEAL.

There has recently grown up in the region named a number of factories, with more or less expensive machinery installed, for the purpose of grinding the alfalfa hay into meal. In order to accomplish this it is necessary that the hay be kiln dried, and even then it is ground at the expense of great power. Hay, as ordinarily made, is not suitable for the manufacture of alfalfa meal, because it contains too much moisture, which renders it exceedingly difficult to grind and more liable to spoil. Experiments made at different experiment stations and also by private individuals have shown that alfalfa meal, when balanced with a corn ration and some kind of roughness rich in carbohydrates, makes a very satisfactory ration for fattening stock, but a prominent cattle and horse breeder who annually harvests 2,000 acres of alfalfa says that, in his experience, the cattle themselves make a very good mill to grind the alfalfa and he finds it too expensive to grind it by other power. He confesses that he has had no very great experience with alfalfa meal as sold commercially, but thinks that the consumer pays a good price for its preparation. The commercial article is made from selected alfalfa and mixed with sugar-beet molasses in the proportion of 75 per cent alfalfa and 25 per cent molasses. The product contains from 15 to 17 per cent of protein and about 50 per cent of carbohydrates and fat. It is being used by numerous feeders in the preparation of their show animals of different breeds because of its combination of the alfalfa, which is the best milk, bone, muscle, egg, and flesh producer known, with a palatable fat-forming substance, which makes it an attractive feed for animals of all classes. The factories manufacturing this product are generally busy to the limit of their capacity, and one of them is reported as turning out as much as 13,000 pounds per day. Some experiments recently made at the Nebraska Experiment Station show that in feeding pigs the largest daily gains were made on corn and shorts, but that a gain practically equivalent was made at a much lower cost where either cut or ground alfalfa was substituted for shorts in the ration. The cheapest gains were made on corn and cut alfalfa.

#### ALFALFA FOR HORSES.

That alfalfa is a valuable feed constituent for horses may be seen by the portraits of World's Fair prize winners which accompany this article. These horses were grown from colthood to maturity on Kansas alfalfa, and they were fitted for the great contest for Perche-

ron supremacy on balanced rations, in which alfalfa was a prominent factor. The owner of the stallion Casino is a very successful grower and feeder of alfalfa, and he reports that a daily gain of 5 pounds is no uncommon experience in the fitting of his animals on this plant. Of course, he uses a balanced ration, and, as alfalfa is too rich in protein for the mature horses, he balances the ration by giving them an allowance of corn fodder, Kafir-corn fodder, or some other roughness rich in carbohydrates. The writer was shown one mare on this farm that made a gain of 6 pounds per day for thirty days and a number of stallions that averaged 5 pounds per day for a like period. The ration fed these animals is composed of corn chop, alfalfa, and corn fodder, varied occasionally with other feeds in which the relative value is maintained. A little salt is thrown into the feed each time, and the animal is given free access to an abundance of salt at all other times. These horses are pastured on alfalfa during its season, and, when fitting them for sale or show, the owner is careful to select only choice alfalfa to give them and retains the tops and bottoms of the stacks to feed to his stock cattle. Horses and mules thrive on alfalfa pasture and will make more growth and make it quicker per acre than upon any other pasture now known. While, as stated before, alfalfa is too rich a food for mature horses unless used in combination with some other roughness, it is an excellent feed for young horses, as it seems to contain just the elements necessary to develop bone, muscle, and consequent size. Caution should be used, however, in feeding alfalfa to horses, particularly if they have not been accustomed to it. Like other concentrated feeds, it seems to stimulate all the physical processes to such an extent that various disorders of the digestive system may appear. This is particularly noticeable in the urinary and perspiratory glands. It should be fed in moderation and mixed with other roughness to work and driving horses, though it is a common practice among farmers in the Southwest to feed alfalfa as the only roughness, and the writer has known of livery stables in this region where no other hay is used. This, however, is not to be recommended. When alfalfa is fed to horses in considerable quantity the grain ration must be proportionately reduced and an abundance of other roughness furnished. When horses have attained a mature age and it is desirable to change from other hay to alfalfa, this change must be very gradual, and the alfalfa selected for this purpose should be more advanced in growth at the time of cutting than that which is to be fed to cattle or sheep. As a general statement, very ripe alfalfa hay is the best to use for work horses and driving horses, while that prepared in the usual way—that is, cut when the field is about one-tenth in bloom—is better for the colts. In any event, horses that are fed alfalfa hay must be given abundant exercise.

## ALFALFA FOR DAIRY COWS.

While the alfalfa plant contains an element of danger for such ruminants as cattle and sheep if fed as pasturage, it is one of the most valuable plants for this same class of live stock after it has been properly prepared, and used either as a soiling crop or as hay. Indeed, its value as a feed for cattle is not yet fully appreciated by our farmers generally, although locally it is held in high esteem. This plant, even in its dried state when fed as hay, affords a happy combination of richness and succulence that is especially adapted to cattle and sheep. It is very palatable, very easily digested, has a cooling and laxative effect, and produces butter fat similar in quality, texture, and flavor to that produced by green pasturage. In addition to this it is the cheapest of all good feeds. Most highly is it valued perhaps by the average dairyman, for the reason that when fed with corn fodder, Kafir corn, straw, or other cheap roughness in the ordinary methods practiced by farmers, it forms a nearly perfect-balanced ration, and relieves the feeder of the difficulties which most men encounter in trying to figure out a balanced ration. A milch cow seems to be able to determine for herself just how much alfalfa and corn or alfalfa and ground Kafir-corn seed she will eat in order to balance the ration. In fact, alfalfa hay is the only single feed that can be used with corn or Kafir-corn seed to make a properly balanced ration for milk production. The Kansas Experiment Station found that by feeding this hay to dairy cows they were able to produce butter fat at 11.9 cents per pound. When they did not have the alfalfa hay to feed, and the rations were balanced with concentrates purchased for the purpose, it cost as high as 17 cents per pound to produce butter fat. Alfalfa hay may be fed to dairy or other cattle throughout the year, but a better practice is to use the alfalfa for soiling during its growing season, especially during the hot and dry months of the late summer and early fall when the pastures become dry and the grass wiry. At the Kansas Station it was found that 10 head of cattle consumed 77,145 pounds of alfalfa, fed as a soiling crop during a period of seventy-four days. When the cost of the grain ration was deducted and the butter fat was valued at creamery prices and the skim milk at 15 cents per hundred pounds, the green alfalfa was found to have netted the station \$25.26 per acre. In 1900 the region in which this station is located suffered from a season of dry weather which lasted from about the middle of June until the middle of July. The tame grasses dried up and the wild grasses became fibrous and woody, while the cattle suffered from the heat and a pest of flies to the extent of causing them to refuse to pasture more than an hour or two each day, and some days they would

not leave the shade of the trees. There were 21 head of milch cows in the herd, which were yielding 289.8 pounds of milk per day. The professor in charge began the practice of soiling about the 20th of June and, after a lapse of three weeks, he found that the cows had actually made a slight increase in yield of milk, although other cows in the neighborhood which had not been so treated had decreased their milk flow from 15 to 20 per cent.

Herewith are shown pictures of dairy and dual-purpose cattle that were notable prize winners at the World's Fair and that were fed and fitted on alfalfa. The Holstein-Friesians shown were fed and developed on alfalfa in central Kansas, and the owner had the satisfaction of retiring from St. Louis with nearly \$2,000 in prize money won on his exhibit of 14 head in a competition with the world.

The States of Kansas and Nebraska now claim to be the homes of two of the largest creamery companies in the world, one of which has a daily capacity of 75,000 pounds of butter at its central plant, while its total output from all its churning stations probably amounts to more than 100,000 pounds of butter per day during the height of the season. These great companies have been made possible by the existence and value to the dairy farmer of the alfalfa plant in this region.

#### ALFALFA FOR STOCK AND FATTENING CATTLE.

That alfalfa has revolutionized methods of feeding beef cattle is abundantly shown by the everyday practice of farmers and feeders in the region where it grows. The former practice of giving fattening cattle all of the shelled or ground corn or Kafir-corn seed they could eat and allowing them to balance their own ration by eating all the prairie hay or other roughness they desired has fallen into disuse, because the farmers and feeders have learned that both corn and Kafir corn are very rich in starchy matter and very poor in protein, and that very large amounts of feed and a long period of feeding are necessary to accomplish the desired results, and because also they have learned that by using alfalfa they have a cheaper feed which will make cheaper beef in a much shorter period. The experience of a very successful feeder may be here quoted as typical of the general practice. This farmer feeds several hundred head of cattle each year and his practice is to carry his stock cattle through the winter by feeding them low-grade alfalfa hay, such as is found at the tops and bottoms of stacks, to which is added oat straw, sorghum hay, corn fodder, prairie hay, or other cheap roughness. The daily ration allowed for each animal is about 25 to 30 pounds of alfalfa and 5 to 10 pounds of other roughness, and from this he makes a gain of from one-half to 1 pound per day for each animal without giving them any grain or other feed of any kind. When the cattle are ready to fatten

for market it is only necessary to add corn chop to this ration, and they are ready for shipping in a very short time.

Baby beef, which has become so popular and profitable in the West, has been made possible by alfalfa. Cattle prepared for fattening by being fed as just described are in the best possible condition and, when ripened with corn, command a high price in the markets. Every farmer who wishes to save all the valuable food substances that exist in his corn and alfalfa will feed the two together, so that what one lacks will be supplied by the other. In this way beef and pork can be grown for the farmer rapidly and at the lowest possible cost. In this connection we quote from a letter lately received from the largest packing house in the United States in regard to the value of alfalfa as a feed for market cattle:

It is customary for our buyers to go over every afternoon when they have nothing else to do, and see the cattle killed that they bought the day before. They seem to think from the feeding qualities of alfalfa that it is the greatest feed with a ration of corn that cattle can have. We can not say that we have ever bought any cattle fattened entirely on alfalfa, but, to come down to the meat, for flavor and tenderness we can not go back on good old corn for fattening. From our own experience and from what we can learn we believe that alfalfa has come to stay, and we consider it the best forage in the shape of hay that cattle can have.

In order to show that results indicated above may be obtained from any crop cut from the alfalfa field, we quote from some experiments made at the Utah Experiment Station, in which 18 head of steers were divided into 6 lots of 3 each and fed on different cuttings of the different crops without grain or other feed. This feeding experiment extended from December 20 to February 21, a period of two months. It was found that the early cutting of the first crop required 19.48 pounds of feed for 1 pound of gain; the medium cutting required 61.23 pounds, and the late cutting 47.01 pounds. In the second crop for the early cutting 20.90 pounds were required, the medium cutting 21.33 pounds, and the late cutting 85.32 pounds. The average for both crops showed 20.19 pounds for 1 pound of gain for the early cutting, 41.28 pounds for the medium cutting, and 66.16 pounds for the late cutting. The results in beef per acre were 412.70 pounds for the early cutting, 217.03 pounds for the medium cutting, and 114.99 pounds for the late cutting. The average gains per day per steer for the alfalfa cut at the best time (before bloom) were, for the first crop 0.778 pound, and for the second crop 0.743 pound. The average pounds of feed for 1 pound of gain, when the crop was harvested before bloom, was 19.48 pounds for the first crop and 20.90 pounds for the second crop. These results were practically confirmed by similar experiments conducted at the Arizona Experiment Station. The results obtained at these two stations served to confirm

what has already been quoted from the feeder mentioned—namely, that one-half to 1 pound per day may be expected as the average gain on stock cattle fed on alfalfa alone. Experiments made this year at the Fort Hays branch of the Kansas Experiment Station give the following results:

The experiment was intended to test the value of native feed in the production of baby beef. Last fall 56 heifer calves, very similar in quality, were chosen and divided into 7 lots of 8 calves each. These animals were grade Shorthorns and Herefords, and the lots were made as nearly equal in weight and quality as possible. The preliminary work consisted in giving the calves a small ration of grain daily and gradually increasing it for about two months until they were on full feed. With this grain they were given all of the roughness they would eat. After they were on full feed they were fed twice a day on the rations given in the following table and in such amounts as they would eat up clean. The grain was all ground to a medium degree of fineness, and the lots receiving corn meal were given corn-and-cob meal throughout the experiment, except during the last three weeks, when the cob meal was omitted. The grain and hay used in the experiment was of good ordinary quality, such as was grown on the station farm and those adjacent to it. The experiment lasted one hundred and eighty-two days. In the table it will be noticed that certain facts stand out prominently. The feeding of alfalfa hay makes a great difference in the amount of grain consumed. The experiment shows a gain for alfalfa of \$2.50 to \$4 per head over sorghum, prairie hay, or straw. The barley and wheat in combination make a good showing. There was a more marked difference in the lots of calves than is shown by the table, though the rank would remain the same as shown by the daily gain. The lots fed on alfalfa developed more evenly than those fed on sorghum, prairie hay, or straw, and hence would have brought a better price on the market. The table is as follows:

Feedstuff.	Begin- ning weight.	Gain per head.	Daily gain per head.	Feed required to make 100 pounds gain.		Animals in good market condi- tion.
				Grain.	Hay.	
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Number.</i>
Corn and alfalfa .....	399	338	1.85	545	388	8
Barley and alfalfa .....	401	297	1.62	519	421	6
Wheat and alfalfa .....	413	284	1.56	404	432	6
Corn and sorghum .....	397	224	1.23	715	592	4
Corn and prairie hay .....	406	262	1.43	641	381	5
Corn and oats straw .....	405	251	1.37	717	354	4
Mixed feeds <sup>a</sup> .....	403	328	1.80	473	414	7

<sup>a</sup> One-third each of the grains and one-fourth each of different hay.

Experiments just completed at the Oklahoma Experiment Station were made to test the effect of common feed stuffs on native steers, such as are found in the vicinity of the station. These steers were picked up when they were yearlings and roughed along until about the middle of December, when they were put in the experimental feed lots and full fed in a test of one hundred and forty days. This is the fifth year in which these tests have been made at this station, and Prof. F. C. Burtis, under whose direction the experiments are made, says that it has been demonstrated beyond any doubt that alfalfa is by far the most economical rough feed that is known for cattle feeding. In proper combination alfalfa will produce more fat for less money and will do it in a shorter time than any other known roughness. There were five lots of cattle in this experiment, which were fed as follows: Lot No. 1 was fed on cotton seed, alfalfa hay, and wheat straw, and showed a daily average gain of 0.43 pound. Lot No. 2 had cotton seed, Kafir-corn meal, and alfalfa, and made a daily average gain of 0.35 pound. Lot No. 3 received shell corn, cotton-seed meal, prairie hay, and straw, and made an average daily gain of 0.95 pound. Lot No. 4 was rationed on cotton-seed meal and wheat straw, with an average daily gain of 0.14 pound. Lot No. 5 was fed on corn meal and alfalfa. This lot made a daily gain of 2.28 pounds and averaged in weight 1,352 pounds when sold. Such results are obtained everywhere that corn chop or meal is used in combination with alfalfa hay. A prominent breeder and feeder of Angus cattle who lives in that portion of Kansas which yet has a plentiful supply of buffalo grass, states that he recently fed 10 bulls on alfalfa hay, prairie grass, and millet as forage with corn chop, oats, and a little bran for grain. They gained on this feed as high as 140 pounds each per month, but when the alfalfa was omitted from the ration they dropped off fully 25 per cent. He adds:

Alfalfa is the best crop grown in Kansas, and alfalfa hay has no rival when fed in connection with other roughness, such as Kafir corn, sorghum, or corn fodder. In this locality if alfalfa is fed entirely alone it is not good for cattle, as it seems to affect the kidneys and to weaken them. If it is fed on buffalo-grass pasture, it is simply grand. It is a balancer for all forage crops and makes them almost equal to grain.

#### ALFALFA FOR HOGS.

All good hog raisers are earnest believers in pasture for their animals. The hog is by nature a pasture-loving animal, and breeders and feeders both recognize the fact that the greatest gains at the least expense are made when the animals have an abundance of pasture. In the East, red clover is a popular plant for the hog pasture.

In the West its place is taken by alfalfa, which is found to be much superior. Alfalfa makes an ideal hog pasture, as it stands the pasturing better than the clover and is a better feed. If about 15 head per acre are allowed to pasture on alfalfa, they will make about an average gain of 100 pounds each during the season, which lasts until about the middle of November. If the weather conditions are suitable, the alfalfa may be pastured by hogs later than this, but the plant must be given some period of rest. The number of hogs mentioned above is much smaller than is found in general practice on such pastures, but if no more than this are turned on the pasture field they will thrive to their utmost capacity, and the owner can occasionally mow the pasture and get hay of quality for horses or for roughing cattle. The effect of mowing is to keep the pasture fresh, which is to the advantage of both the pasture and the pig. While all breeders and feeders unite in testifying as to the value of alfalfa pasture, they are equally enthusiastic in their claims of the value of alfalfa hay for winter feeding or for hogs that are necessarily confined to dry feed lots. Kansas and Nebraska are now known as two of the best of hog-breeding States, and this reputation has been gained by reason of their large acreage of alfalfa. Nowhere has pork been produced of such good quality and such low cost as in the territory where alfalfa thrives, and one might almost venture a prediction that in the near future the cheapest and best pork will all come from the alfalfa fields of the Southwest.

The Kansas Experiment Station made a test of feeding young hogs in a dry feed lot by giving one lot a ration of alfalfa hay in addition to the grain ration to which both lots had been previously accustomed. The two lots of hogs under consideration were fed fifty-six days. The lot fed alfalfa in addition to the grain ration showed a total gain of 812 pounds on 12 head, while that without the alfalfa showed a total gain of 799 pounds on the same number of head. The alfalfa used in this experiment was not of good quality, however. Another experiment at the same station was made by selecting 60 ordinary stock hogs of mixed breeding and of an average weight of 125 pounds and feeding them for sixty-three days on Kafir-corn meal with and without other feeds. The gains per bushel of feed are reported as follows: Lot 1, fed on dry Kafir-corn meal and 7.83 pounds of alfalfa hay, gained 10.88 pounds per bushel; lot 2, dry Kafir-corn meal alone, gained 7.48 pounds; lot 3, wet Kafir-corn meal alone, gained 8.09 pounds; lot 4, whole Kafir corn alone, 8.56 pounds. A little computation develops the fact that this experiment shows a gain in feeding alfalfa hay with Kafir corn to fattening hogs of 868 pounds of pork per ton of the hay. If we value the hay at \$3 per ton and the fat hog at 3 cents per pound live weight, the Kafir corn fed alone brought 22.4 cents per bushel. The Kafir corn

fed with alfalfa hay brought 31.4 cents per bushel. The hay used in this experiment was of the best quality, carefully cured with all the leaves on. When these experimental hogs were butchered it was found that lots fed on Kafir-corn meal and alfalfa hay dressed out 79 per cent of live weight with a firmness of the fat far above any other lot and of a good white color not customarily found in corn-fed hogs. The distribution of fat and lean was extra good.

Alfalfa is of special value as a developer and bone producer in young and growing hogs. Professor Henry, of Wisconsin, made an experiment along this line which is very interesting. One lot of pigs was fed on a ration of milk, middlings, and dry blood—a ration rich in both protein and mineral matter, like alfalfa. Another lot was fed on corn—a feed deficient in both. The pigs fed on the first ration named made a gain of nearly one-fifth more than those fed on corn, and their bones were 32 per cent stronger. Experiments made at the stations in Wisconsin, Missouri, Alabama, and Kansas showed that an abundance of protein and mineral matter in the feed of pigs not only increased the strength of the bones, but also increased the development of the muscles and vital organs and showed greater strength and health, with a larger proportion of lean meat in the carcass. In some of the experiments quoted alfalfa was not used to furnish the protein and mineral matter necessary. In others where it was used it is shown that the same results are attained at a very much less cost. Alfalfa hay is exceedingly rich in both protein and mineral matter. A ton of alfalfa hay contains 51 pounds of potash, 44 pounds of lime, and 11 pounds of phosphoric acid; while a ton of corn contains 8 pounds of potash, 3 pounds of lime, and 14 pounds of phosphoric acid. Besides being rich in protein and mineral matter, alfalfa is bulky, which is a very desirable quality where young animals are being forced during the bone-forming period. Many breeders of purebred hogs find that their animals have excellent characteristics in every respect except that of bone. Animals which have been inbred, or line bred, for a long period are likely to be small of bone and to have splay feet. A constant ration of alfalfa will be found to correct these evils and change the nature of the herd in a few generations at most. It is best to begin by feeding the dam on alfalfa, so that her pigs may have a right start in life. It has happened in Kansas and Nebraska within the last ten years that there have been at least two seasons when a large part of the territory of these two States was deficient in corn of a quality satisfactory to feeders. The result was that many herds of hogs were carried through the winter almost entirely on alfalfa hay. When spring came it was found that the animals themselves were in good condition and that the litters of pigs were unusually large and strong.

It must not be understood that alfalfa will furnish all of the

mineral matter that is needed for the proper development of the bones in the young pigs. They should receive all the corncob charcoal they will eat in addition to other feeds. This does not apply to the young of any other kind of animal, but does seem necessary in the case of pigs.

The facts here stated have much significance to the hog breeders of the country when they consider that their best market for fine hogs now lies in the alfalfa country. Heretofore this country has been largely devoted to wheat growing and the farmers have not become noted as breeders and raisers of purebred stock, because of the firmly fixed belief in the minds of the early settlers that it was impossible to raise hogs without corn. With the advent of alfalfa and its rapid gain in popularity, this region has opened up as one of the greatest stock-producing sections of our country and a section which has the advantage, with the aid of its alfalfa, of being able to produce marketable hogs in a shorter time and of better quality than any other region with which the writer is familiar.

At the World's Columbian Exposition, held at Chicago in 1893, a Kansas breeder of Poland-China hogs secured seven prizes on eight animals shown. These animals were pastured on rye and wheat during the late fall and winter months and were fed alfalfa during the other eight months in the year. Most of the Kansas hogs that won prizes at St. Louis in the Louisiana Purchase Exposition were raised on alfalfa pasture and hay.

The Nebraska Experiment Station divided 20 pigs of uniform type and condition into 4 lots of 5 each and fed them on different rations. The result was that the lot which was fed on corn alone made an average gain of 0.93 pounds per day, that fed on corn and skim milk gained 1.57 pounds, that fed on corn and shorts gained 1.20 pounds, and that fed on corn and alfalfa gained 1.20 pounds. With the value of \$7 per ton for the alfalfa hay, \$12.50 per ton for the shorts, corn at 30 cents per bushel, and skim milk at 15 cents per 100 pounds (the usual prices at the time of the experiments), and an addition of 6 cents per 100 pounds for grinding the corn, each 100 pounds of gain in the several lots of hogs cost as follows: Lot 1, fed corn only, \$4.48; lot 2, corn and skim milk, \$3.97; lot 3, corn and shorts, \$3.53; lot 4, corn and alfalfa, \$3.40. It will be seen by the figures given that the average gains made by the lots fed on corn and shorts and on corn and alfalfa were the same, but that the corn and alfalfa lot was 13 cents per 100 pounds cheaper than those fed corn and shorts, and \$1.08 per 100 pounds cheaper than the lot fed on corn alone. Stated in a different way, the experiment shows that at the time and under the market conditions obtaining when it was conducted, skim milk made the corn bring 4 cents more per bushel, wheat shorts made it bring 8 cents more, and alfalfa 9 cents more. This means that in a State like

Nebraska the substitution of alfalfa for one-fifth of the corn that is usually fed to hogs would bring more than \$1,000,000 per year of added wealth to the State. A slaughter test made of these pigs showed that the lot receiving alfalfa had a greater development of muscle and of vital organs, and a test of the strength of the bones was made which showed that the bones of the corn-fed pigs broke at an average of 325 pounds, when the thigh bone was supported at each end and pressure applied in the middle by a testing machine. In the case of the corn and alfalfa pigs the average breaking strain was found to be 510 pounds. From these facts it is evident that the breakdowns which often occur in heavy corn-fed hogs are the fault of the feed rather than of the animal. This same experiment showed that the size of the bone was slightly greater in the corn-fed hog than in the corn and alfalfa fed hog, but the testing of the strength of the bones showed that the corn-and-alfalfa pig had much denser bone, and that these were enabled to withstand nearly 200 pounds more pressure before breaking.

In preparing alfalfa hay for hogs it is better to cut it early so that a larger proportion of leaves may be saved and consequently a larger proportion of protein conserved. As was heretofore mentioned, a late cutting, after the leaves have fallen somewhat and the stem hardened, is better for horses, but for pigs, especially growing pigs, the crop should be so harvested as to save the largest number of leaves. Experience teaches also that the third or fourth crop is better for pigs because it is softer and more palatable. It is always wise to provide some kind of a trough or rack with a floor in it for feeding alfalfa to hogs; otherwise the leaves, which are the most valuable portions of the plant, are lost by being trampled in the mud and the more woody proportions remaining are not eaten so greedily by the hogs.

Alfalfa is an ideal feed for brood sows, and when it is so used the hard-luck stories about the loss of pigs, which are so frequent in the district where corn alone is fed, will not be heard. Experienced breeders as well as veterinarians both assure us that a thrifty condition is the best preventive of disease. Hence it follows that the breeder and feeder who is liberal with his rations of alfalfa is not troubled so frequently or seriously with swine diseases.

#### ALFALFA FOR SHEEP.

Practically all that has been said about the value of alfalfa for cattle will apply when sheep are considered, except that sheep are much more susceptible to bloat from eating green alfalfa than are cattle. Hence it is that alfalfa as a sheep feed is used almost entirely in the form of hay. Sheep fed on alfalfa with proper grain rations and other roughness make the same rapidity in growth as do other

animals and have a larger yield of fleece. They also develop much younger, so that the sheep raiser who grows them for mutton can place them on the market much earlier than he can with any other combination of feed. Sheep are extremely fond of alfalfa, as are all domestic animals, and nothing has been discovered which will take its place in the developing growth of the animal and production of mutton and of fleece, but it must always be fed as a hay.

#### OTHER USES OF ALFALFA.

Alfalfa in its green state, or when used as hay or ensilage, is a first-class poultry food. Poultry will pasture on it during the summer and thrive. The considerable number of insects which they get while pasturing only adds a desirable item to their bill of fare and helps them in their development and their egg-laying powers. As alfalfa remains green throughout the winter, it makes an excellent winter pasture for fowls, although, of course, it will not do to allow them to pasture it closely or the crop will be injured if not destroyed. In the winter season poultry which have access to stacks of alfalfa or to barns or sheds in which it is stored make a better growth and continue egg laying much longer than do those which do not have access to it. Poultry will feed voraciously on the dry leaves of the alfalfa plant when they have access to it, and much of the fine material shattered off from the hay in the hay mow may be used to great advantage in feeding them. As this shattered material is mostly leaves, it is the best part of the plant and can be fed alone or mixed with other feed. The nitrogenous element of alfalfa is just what is needed for the development of the young fowls, as well as for the production of eggs, and a number of so-called poultry foods are said to be composed in part of ground alfalfa. It is best for poultry to use the last cutting of alfalfa, as it is softer in texture, has a larger proportion of leaves, less woody matter, and is more succulent than any other cutting. While poultry of all classes will eat alfalfa hay, or at least the leaves from it, and thrive, it is undoubtedly a better practice to chop it or grind it and mix it with a grain ration. A good practice is to steep the alfalfa hay in hot water and let it stand for several hours before feeding. If this is done and the grain ration mixed with it, the effect is practically the same as though the birds were fed on the green alfalfa. Corn meal and ground alfalfa, steeped in hot water or steamed to soften it, makes an ideal balanced ration for winter poultry feed. The real value of the alfalfa plant for poultry is not yet appreciated.

In many sections of the West, especially on the plains of Kansas, Nebraska, and Oklahoma, farmers find a very profitable investment when they buy a few stands of honey bees. As the alfalfa grows rapidly and blooms early, and as its season of growth is a long one, it is

found to be one of the best and most profitable plants yet discovered for bee pasture. It is a common practice in some of the smaller towns in the alfalfa region for residents to maintain a considerable number of colonies of bees which pasture on the alfalfa fields belonging to their neighbors. The bees will begin working on the alfalfa fields early in June in the more southern parts of the alfalfa region, and may continue until late in October, and the honey produced from this source is superior to that derived from the buckwheat, white clover, or sweet clover, although it is darker in color. In fact, it is the belief of the writer that there is no honey produced from any source that equals in quality and flavor that from the alfalfa plant. Climatic conditions which retard or too greatly accelerate the growth of the plant will have their influence on the production of honey. If the season is too dry the blossoms seem to contain little honey, while if it is too wet the honey seems to be greatly diluted. In a favorable season 100 pounds per stand of bees would be a common yield. The writer has a neighbor who lives in the suburbs of a city of 45,000 people and who has a number of stands of bees on his town lot. During the season of 1903 his bees produced for him 2 tons of honey, chiefly gathered from the near-by alfalfa fields, on samples of which he secured first prize at the State fair on an exhibit of alfalfa honey.